DEVELOPMENT OF RESIDENTIAL FLOOD DEPTH-DAMAGE CURVE FOR KUANTAN, PAHANG

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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Specially dedicated to
my beloved late brother,
Mohd Hanis bin Mohd Razaki
who have died from
car accident during my first
year degree journey (2015).
This is for you, Brother.

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ABSTRAK

Dalam tahun kebelakangan ini, banjir sering berlaku dan meninggalkan kesan yang teruk di kawasan banjir. Oleh itu, ia merupakan satu isu penting bagi setiap negara untuk mencegah dan mengurangkan kadar kerosakan banjir. Tujuan kajian ini adalah untuk menilai kerosakan banjir secara langsung yang telah dialami oleh mangsa banjir pada tahun 2013 di Kuantan dan mengenal pasti faktor-faktor yang mempengaruhi tahap kerosakan banjir. Kadar kedalaman banjir di kediaman dibangunkan berdasarkan data kerosakan yang dikumpulkan semasa tinjauan temu bual. Peratusan kerosakan dikira dengan membahagikan kerosakan struktur atau kandungan anggaran dengan nilai kerosakan sebenar. Mengikut jenis bahan binaan, kerosakan struktur secara purata adalah RM2642, RM2250 dan RM2120 masing-masing untuk bata, kayu dan bata dan rumah kayu. Kerosakan kandungan isi rumah untuk semua jenis bahan adalah lebih tinggi antara RM 4104 hingga RM 4556 bagi setiap harta benda. Kebanyakan rumah adalah satu rumah teres dengan purata kerosakan sebanyak RM 2250 bagi setiap harta tanah. Daripada analisis SPSS, kadar kerosakan dipengaruhi oleh harga rumah, bahan binaan dan pendapatan isi rumah. Dengan nilai R^2 dari 0.98 dan 0.82 untuk kandungan dan kerosakan struktur masing-masing, lengkung kerosakan kedalaman banjir yang diperolehi dalam kajian ini adalah cukup baik dan boleh digunakan untuk kajian masa depan mengenai penilaian risiko banjir di kawasan kajian.

ABSTRACT

In recent years floods occur frequently and cause severe impacts to the flooded areas. It is consequently an important issue of many countries to prevent and mitigate flood damage. The aim of this study is to assess the direct tangible flood damage experienced by the victims of 2013 Kuantan flood and to identify the factors that influence the level of flood damage. A residential flood depth-damage curve is developed based on the damage data collected during interview survey. The percentage of damage is calculated by dividing the estimated structural/content damage with the actual damage value. According to the types of construction materials, the average structural damage is RM2642, RM2250 and RM2120 for brick, wood and brick and wood house respectively. The content damage for all types of materials is higher which is between RM 4104 to RM 4556 per property. Most of the houses are one storey terrace house with average value of damage is RM 2250 per property. From the SPSS analysis, the rate of damage was influenced by house's price, construction materials and household income. With R^2 of 0.98 and 0.82 for content and structural damage respectively, the flood depth-damage curves obtained in this study is good enough and can be used for future studies on flood risk assessment of the study area.

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R^2	Coefficient of determination

LIST OF ABBREVIATIONS

MOLAND	Monitoring Land Use/ Cover Dynamics
1D	1 Dimensional
2D	2 Dimensional
3D	3 Dimensional
GIS	Geographical Information System
SPSS	Statistical Package for the Social Sciences

CHAPTER 1

INTRODUCTION

1.1 Introduction

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over normally dry areas. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Mild flood may have some impact on people or property, such as damage to the landscape or resulting in undesirable debris. While, severe flooding can often destroy buildings, crops, and can also cause severe injury or maybe death (FEMA, 2008).

Flood risk assessment is the systematic approach to identify how flooding impacts the environment. In hazard mitigation planning, flood risk assessments are the basis for mitigation strategies and actions by defining the hazard and enabling informed decision making. The danger of flooding can't be basically distinguished by knowing where the flood happens. The most well-known strategy for deciding flood risk are hazard and vulnerability assessment (FEMA, 2008).

Flood damage assessment is a basic segment of flood risk mitigation. To assess measures that can be taken to moderate the harms from flooding, evaluation of harms must be led utilizing direct assessment or modelling approach. Without clear and reproducible flood damage assessment, analysis is extremely troublesome, and the administration of hazard is less dependable (FEMA, 2008).

The estimation of damages caused by floods usually focus on the flood depths. That is why the flood depth-damage curves have been used in several locations around the world as the most commonly used method for assessing the impact of floods (Merz et al., 2010). The flood depth-damage curves can also be classified as absolute or

relative, depending if the cost is given in economic terms or as a percentage of the total value of the asset that has been affected. There are two factors influencing the damage that are the impact parameters and the resistance parameters. The impact parameter reflects the specific characteristics of a flood event (such as water depth, flow velocity, etc.) and for the resistance parameters represent the properties of the affected assets (such as building type or materials, emergency measures used, etc.) (Merz et al., 2010). It has been concluded that, with the exception of flood depth, most of the influencing factors that have been affected have been neglected in the modelling of the damage (Merz et al., 2010).

A flood risk approach seems to have significant potential in reducing flood impacts. However, the implementation of this method is still new and lack of available literatures regarding to it, especially on the derivation of flood damage function curve. Hence, with the aim to assist in the assessment of flood risk in Malaysia, it is compelling to carry out a study on the development of site-specific damage curve that reflects the local condition of the study area.

1.2 Problem Statement

Floods often cause significant losses to people and properties. The expected losses in residential area are lower than commercial or industrial area, hence the damage estimation is often neglected or only accounted for by using simple approaches and rough estimates (Merz et al., 2010). However, due to the higher concentration of population and asset nowadays, the vulnerability of residential area is increased, thus needed a detail damage assessment that can also be used to predict future flood effects (Diakakis et al., 2017).

Many previous researchers such as Herath (2003) and Chinh (2017) used modelling approach to estimate flood damage compared to direct assessment. Assessing damage using direct method is time-consuming and costly. Furthermore, the assessment was based on the respective flood event only. In contrast, the modelling approach can be used for any flood event as the depth-damage curve is expressed in percentage (Oliveri and Sontoro, 2000). Using our own damage curve is appropriate to reflect the effect of local condition to damage estimates. Hence, an attempt has been made to

conduct a study on flood damage assessment in an urban area where a site-specific flood depth-damage curve was produced.

1.3 Objective of the Study

The objective of this study are:

i. To assess the direct residential flood damage of 2013 Kuantan flood and identify the factors that influenced the level of flood damage.

ii. To develop a residential flood depth-damage curve for Kuantan based on 2013 flood event.

1.4 Scope and Limitation of Study

In order to conduct this research study, the data from the interview survey was collected from residential area of Kuantan, Pahang. Kuantan is one of the big flooded city that has been affected during 2013. The focus of this research is to get the estimation of direct tangible damage which included the damage caused by direct contact with water, and contains most of the insurable losses. Flood depth-damage curve is the plot of flood damage versus corresponding flood parameters. This study only considers flood depth as the flood parameter.

1.5 Significant of Study

Flood depth-damage curve is the important element in the assessing of flood damage. The depth-damage curve is used as the input in flood damage modelling. The developed damage curve may be applied to the further flood damage estimation works of Kuantan. The identification of socio-demographic or other related factors that influenced the level of flood damage is useful for future planning of damage assessment studies in Kuantan.

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